

# NEWSLETTER

## Homebrew Computer Club

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Typesetting, graphics and editorial services donated by Laurel Publications, 17235 Laurel Rd., Los Gatos, CA 95030 (408) 353-3609

### RANDOM DATA

By Robert Reiling

**MEETING**—Nov. 12, 1976. A capacity crowd was on hand, estimated at over 450 people for this meeting. Anderson Jacobson, Inc. had their terminals and, as promised, provided an informative talk about the Selectric machine as used in their terminals. Particularly interesting was the discussion of the way that the type ball is positioned to print a character. Also, the differences in the I/O unit as compared to the office unit were listed. The I/O Selectric is a heavy duty machine developed for computer use and workloads. The office Selectric does not have the heavy duty features.

M&R Enterprises demonstrated the Astral 2000 with the special version of BASIC which has been specifically designed to operate in the Astral system. The Astral is available in fully assembled, turn-key condition as a partially assembled kit. The kit saves a lot of money and is easy to put together since the majority of the electronics are preassembled, burned in and tested. Marty Spergel and other representatives from M&R discussed these and other features of this computer system. If you missed the meeting you may obtain Astral 2000 information by writing M&R Enterprises, P.O. Box 61011, Sunnyvale, CA 94088.

**S-100 SYSTEM SYMPOSIUM**—Nov. 20, 1976. Well over 100 people attended the S-100 System Symposium held at Diablo Valley College. Three perspectives were given by Dr. Harry Garland, George Morrow and Lee Felsenstein. It was noted by Lee Felsenstein that a large variety of products are available that utilize this bus. Harry Garland pointed out that the bus system is basically a good product. George Morrow discussed the complex nature of the bus. A panel discussion, moderated by Jim Warren, brought out a number of opinions but the panel generally agreed the S-100 bus system will be used for several years because so many products use it. In order to get better definition of bus signals and electrical requirements, it was suggested that publishers print more bus information and act as a clearing house for comments.

This was the first symposium held covering the S-100 system. It was very well done and certainly informative to all in attendance. Indeed, it seems everyone must have learned something new. The

organizers Dr. W. J. Schenker, and R. J. Hendrickson are to be congratulated.

**MORE ON THE S-100**—April, 1977. The First West Coast Computer Faire being held April 15-17, 1977 at the San Francisco Civic Auditorium, Northern California's largest convention facility, will have a conference session on the S-100 bus according to Jim Warren, Faire Chairperson. You can participate in this session or others scheduled for the Faire. Write or call Jim Warren, Box 1579, Palo Alto, CA 94302, (415) 851-7664 or 323-3111.

**LETTER**—November, 1976. Samuel H. Daniel, Vandenberg AFB, CA sent a letter asking to be put on the mailing list and enclosed a donation. He commented as follows on his activities, "I presently have an 18K Digital Group 8080 System, to which I may add a pair of Phi-Decks and a controller. It works as advertised and went from bits and pieces to assembled and tested in only 14.5 hours. Needless to say, I'm pleased with and recommend it." Thank you for the product information and for the contribution to the Newsletter.

**CONTRIBUTIONS**—The Homebrew Computer Club Newsletter is supported by contributions, both of articles and money. Your articles help keep information flowing and all of us benefit. In this issue you will read about what others are doing with their computers. What are you doing? Do you have favorite software idea? How about a product evaluation? Send me your article for the Newsletter.

Money, of course, is another requirement of the Newsletter. Printing and postage are very expensive and so it follows the Newsletter costs a reasonable amount to produce and distribute. Please keep your contributions coming in. Mail to Homebrew Computer Club Newsletter, P.O. Box 626, Mountain View, CA 94042 or meet me at the next Club meeting. □

### ONE MAN'S SYSTEM

By Charlie Pack

My background is in programming, including 10 years of experience mostly on large-scale IBM systems. I've used IBM 1401 Autocoder, IBM 360 Assembler, PL/I and COBOL for many varied applications, including some of my own personal accounting and inventory chores. In 1973 I went to work for an electronics

firm which manufactures intelligent terminals using the then-new Intel 8008. Although I didn't program the 8008, it soon became apparent to me that microprocessors were good for a lot more than just formatting data on a video screen or controlling traffic lights.

In the meantime, I had gotten interested in digital electronic circuitry while building digital clocks and meters, and finally I built and got running a Radio-Electronics "TV Typewriter" (the TVT-1, with the boards that are stacked like cordwood). Then the bug hit me for sure—I wanted my own computer. So in November 1975 I devised a point system and rated all of the available hobbyist computers.

I had been renting time on an IBM 360/30 for \$30 per hour, so I wanted the capability to run a high-level language and later a disk operating system. The clear winner was determined using my point system and right after New Year's my Altair 8080 kit arrived (when I ordered my Altair I didn't know about the IMSAI computer).

At the present time I have up and running in my Altair a Processor Technology motherboard, 3P+S I/O interface, two 4KRA static memories and two 4K dynamic memories. I use an ASR-33 Teletype machine for I/O. MITS BASIC version 3.2 is used for all accounting applications at present.

The aforementioned hardware is now being used to do investment portfolio and income tax analysis and to produce a cross-reference index to magazine articles. The hardware now being used represents a practical minimum for the performance of the applications now being run.

Assuming that the necessary planning and analysis has been done, computer implementation of most simple business-type applications not involving large amounts of data involves four basic needs:

- a) Some means of transferring original data from documents to the computer. For an on-line system this is done using a suitable keyboard and some type of edit/update program.
- b) Some means of storing the data outside of computer memory.
- c) Processing of data, usually involving data selection or sorting logic and calculations.
- d) Reporting of the desired information to the user. This is the end product of the system.

The BASIC line editor itself satisfies the first two needs in my applications. Here is a complete on-line data entry program which can add new data, change existing data and delete data. Of course, the entire data file is in memory, but allowing 6K for BASIC and 4K for a good-sized program (leave out comments and use multiple statements per line to save memory space), leaves 6K bytes remaining for data.

That's enough for 100-150 transactions with 3-6 data items per transaction, using DATA statements. A year's investment portfolio transactions are no problem! I use line numbers of 10000 and up for DATA and less than 10000 for program code. The command LIST 10000 stores the updated data file on paper tape.

The latter two needs are satisfied by programs I write in BASIC and use with the printer on my ASR-33. By following set conventions for line numbers and by using common subroutine for READING data, a

programmer may use a DATA file with several programs. To print out or punch the program code only, 1 type LIST and when the last statement starts to print I hit control-C a couple of times to stop it.

Although my implementation of investment portfolio is crude, it illustrates that minimum hobbyist-type equipment can be practically utilized for many small business needs. A video display such as the Processor Technology VDM-1 and a tape cassette storage system could be substituted for—or used in addition to—the ASR-33. The use of Extended BASIC would greatly facilitate separate storage and manipulation of data and programs and the display of formatted reports.

My future plans, as far as hardware is concerned, include the acquisition of more memory, a ROM monitor which can be used to load BASIC, a video display, cassette tape interface and hardware backup capability. By the time this article is in print, I will have a Processor Technology 8KRA RAM board and a MITS PROM board up and running, with a system monitor in six 1702A PROMs. The latter has loaders for MITS BASIC (any version) and for software in the Intel hex format, a block move, full TTY support, and switchable hexadecimal or octal mode capability, in addition to normal monitor functions. It will be made available to hobbyists via the HBCC library and through the Byte Shop in Santa Clara.

My future plans for software include enhancement of the monitor to support tape cassette I/O and some type of video monitor display. Memory diagnostics, games and other programs will be developed for use with the run on a cross-assembler of my own design and written in ANSI COBOL for execution on a medium- or large-scale system. A suitable alternative to this would be a Processor Technology ALS-8 development system and a DECwriter or similar printer, if the latter could be obtained at a reasonable cost.

I would be interested to hear from other hobbyists as to what they would like to see in the way of software for the 8080 or Z80. How about a full operating system for multiple cassette tape drives? What features would you like it to have? Is there an interest in games (such as Star Trek) in machine language for small-capacity systems? I can be reached at 25470 Elena Rd., Los Altos Hills, CA, 94022. Home phone (415) 941-0495, between 7 and 10 p.m. on week-day evenings would be preferred. □

### WISCONSIN AREA COMPUTER SOCIETY

By Robert Relling

The Wisconsin Area Computer Society has been holding monthly meetings for the last twelve months and has a paid membership of over 80 persons. They are establishing a good software library, and can communicate via Cassette Tape (Tarbell, Digital Group and K. C. Standard) and Paper Tape. Recently they published their first newsletter. Contact Don Stevens, Chairman, Wisconsin Area Computer Society, P.O. Box 159, Sheboygan Falls, WI 53085. □

**GETTING THE  
MOST OUT OF TINY BASIC**  
*Tom Pitman*

*Continued from last issue.*

**Execution Speed**

TINY BASIC is actually quite slow in running programs. That is one of the hazards of a two-level interpreter approach to a language processor. But there are some ways to affect the execution speed. One of these is to use the keyword "LET" in your assignment statements. TINY BASIC will accept either of the following two forms of the assignment statement and do the same thing.

```
R=2+3
LET R=2+3
```

but the second form will execute much faster because it is unnecessary for the interpreter to first ascertain that it is not a REM, RUN or RETURN statement. In fact, the LET keyword is the first tested, so that it becomes the fastest-executing statement, whereas the other form must be tested against all twelve keyboards before it is assumed to be an assignment statement.

Another way to speed up program execution depends on the fact that constant numbers are converted to binary each time they are used, while variables are fetched and used directly with no conversion. If you use the same constant over and over and you do not otherwise use all the variables, assigning that number to one of the spare variables will make the program both shorter and faster. You can even make the assignment in an unnumbered line; the variables keep their values until explicitly changed.

**Debugging**

Very few programs run perfectly the first time. When your program doesn't seem to run right there are several steps you can take to find the problem.

First of all, try to break it up into its component parts. Use the GOTO command and the END statement to test each part separately if you can. Add extra PRINT statements along the way to print out the variables you are using; sometimes the variables do not have the values in them that we expected. Also the PRINT statements will give you an idea as to the flow of execution. For example, in testing the sort of program above (lines 500-700) I inserted the following extra PRINT statements:

```
525 PR "X";
545 PR ".";
555 PR .
```

This gave me an idea where in the sort algorithm I was, so I could follow the exchanges (the "x's), where each line represented one pass through the main loop. Endless loops become more obvious this way.

If you have not used all the sequential line numbers, you can insert breakpoints in the program in the form of a line number with an illegal statement—I like to use a single period, because it is easy to type and does not take much space:

10 LET A=B+1234

11 .

20 GOSUB 100+A

Here, when you type RUN, the program will stop with the error message,

**!184 AT 11**

Now we can PRINT A, B, etc., to see what might be wrong, or type in GOTO 20 to resume, with no loss to the original program.

As we have seen, there is not much that TINY BASIC cannot do (except maybe go fast). Sure, it is somewhat of a nuisance to write all that extra code to get bigger numbers or strings or arrays, but you can always code up subroutines which can be used in several different programs like the floating point add above (line 1000-1250), then save them off on paper tape or cassette.

Remember, your computer (with TINY BASIC in it) is limited only by your imagination.

**REFERENCES:**

- (1) *TINY BASIC User's Manual*. Available from Itty Bitty Computers, P.O. Box 23159, San Jose, CA 95153.
- (2) *Doctor Dobb's Journal*, No. 7, p. 26. Available from PCC, P.O. Box 310, Menlo Park, CA 94025.

Finally it should be noted that GOTOS and GO-SUBS always search the program from the beginning for their respective line numbers. Put the speed-sensitive part of the program near the front, and the infrequently used routines (set-up, error messages, and the like) at the end. This way the GOTOS have fewer line numbers to wade through so they will run faster. □

**INEXPENSIVE GRAPHICS**

*Workshop Announcement*

A workshop regarding inexpensive graphics is being planned on the East Coast. It will be held next year and is sponsored by Siggraph of the A.C.M. Interested people may contact William Etra, 42 E. 23rd Street, 7th Floor, New York, NY 10010. □

**ABOUT  
RECONNECTING THE IMSAI  
POWER TRANSFORMER**

*By Dave Klinkade*

When I changed the line input connections to my IMSAI transformer (a Trane 3751), I was chagrined to learn that it did not match the diagram on the PS-B schematic (Rev. 2, 3/3/76).

The terminals are actually: (1) common, (2) for 105 V, (3) for 115 V, (4) for 125 V. For example, I connected to (1) and (4) instead of (1) and (3) to lower the output voltage and generate less regulator heat. □

THE FIRST  
WEST COAST  
COMPUTER FAIRE  
*A Conference & Exposition*  
on  
Personal & Home Computers  
april, 1977 • san francisco

P.O. Box 1579, Palo Alto, CA (415) 851-7664, 323-3111

HOW I BUILT  
MY FIRST COMPUTER,  
OR FOOLS RUSH IN WHERE  
ENGINEERS FEAR TO TREAD

By Norman Walters

A course, "Introduction to Computing," taken during the fall of 1975 was my first exposure to the wonderful world of computers. By mid-term, the itch to have my own was beginning to be felt. The itch faded considerably when the prices of the computer kits on the market was considered. After much thought, I decided one could be built at home at a price my wife would not be able to use as grounds for divorce. Naturally, the fact that the largest project previously tackled was a digital clock did not cool my optimism a whit.

Ten months later my home brew computer is built and the cost was much smaller than if a commercial kit had been purchased, but the time and effort expended have been tremendous.

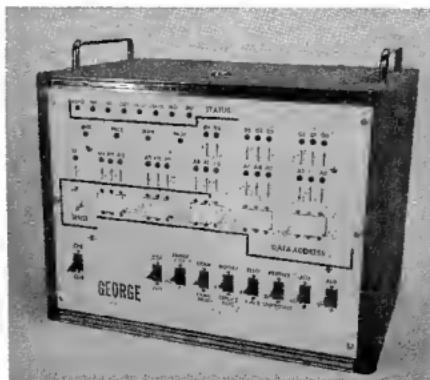
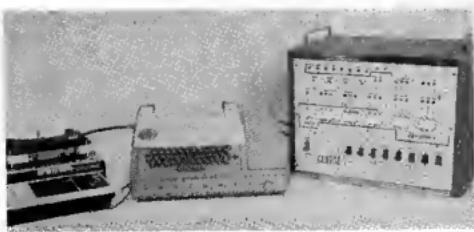
During the construction of GEORGE, every cost-cutting trick possible was employed. Naturally, the mother board was built from scrap cut-offs bought at the club, and 80-pin connectors were cut to form 100-pin connectors. Every friend I had plus some who had not realized that we were even on speaking terms was presented with a list of parts needed and a strong hint given, "If you have any of these parts just lying around, you might be able to force me to take them off your hands if the price is right!" I haunted all the surplus electronics stores and pored over the Poly Pak catalog like it was a dirty book. Because of this approach (cheap), parts did not present a major problem. The CPU board and control panel board required the largest outlay of time. After some initial delays, both were purchased through the club by group buy.

Building the boards up took relatively little time. The largest block of time during construction was devoted to running wire. A total of nearly 1,000 feet of 26 ga. and 100 feet of 16 ga. was used. Checkout was prolonged considerably by the unfortunate insertion of the CPU board backwards in the motherboard. The snaps, crackles and pops would have done Rice Krispies up proud. Invaluable assistance by a long suffering friend, Grant Connell, finally got GEORGE up and running.

The system at the present time consists of the 8080 microcomputer with 24K of 2102 RAM, 12K of 1702A EPROMs, a KSR-33 Teletype, a cassette recorder, I/O boards for the teletype and cassette plus a high speed paper tape punch. Within the next six weeks, GEORGE will acquire a high speed paper tape reader and a VTT 4000B video terminal.

I can tell the memory of the pain, sweat and frustration incurred during the construction is beginning to fade. A few weeks ago, I saw the ad for the Micro Nova minicomputer chip set and thought, "Why, I bet that I can get one of those jewels up and running for almost nothing!"

By the way, I have a list of parts that you have probably got just sitting around gathering dust.... □



**TINY BASIC  
OR HOW MY FAMILY  
CAME TO LOVE MY COMPUTER**

By Ray Boaz

One sure way to get the support of your family for all the hours that you spend with your computer (only) is to let them get some "hands on" time. The problem is how many kids, let alone wives, understand binary, octal, hex or getting a program into the %\$&† thing to do something. So how do you do it? Well I got Tiny BASIC for my AMI Proto system (by Tom Pittman) and it worked out just great.

The first thing I did was write a program for my nine year old girl, Heidi, to use for her multiplication facts. After one minute she was really into it. The program generates two random numbers less than twelve, prints them (i.e.  $9 \times 11 =$  ), waits for the product to be typed in, and then compares the entered product to the calculated product. If the answer is correct a new

line is given. The computer can keep score and if the problem was a "hard" one, a "VERY GOOD" is printed. This is a short and simple program, but to a nine year old girl, it is like magic.

I didn't get off that easy, however. At my side all the time (or was it on top of me) was my son, Chip, who is only six. Since he is not up to multiplication yet I had to do something else. If Tiny BASIC could multiply that easy, it must be at least as easy to do the addition facts. So with a few changes in the same program, another member of the family was into the computer.

Well, that accounts for two out of three. What about my wife? Glad you ask. She does not glare at it when she walks by and has even started saying some almost nice things about it. If this keeps up, I may have to start on another computer for myself.

Oh, one other thing. Heidi is busy setting up times for her friends and making arrangements to take the new toy to school. There seems to be no end of what can happen when your kids can compute. □

## BULLETIN BOARD

**For sale:** Cryptographic program that will baffle the codebreakers of the CIA. ENCODE and/or DECODE your private correspondence for maximum security. Documentation of cypher technique, program listing and punched paper tape in BASIC for only \$6. Jon Stedman, 1528 Summit Rd., Berkeley, CA 94708.

Kleinschmidt 311 printer, 40 char/second, 80 characters wide, parallel ASCII input, level conversion from -12 V can be tapped from printer power supply, full documentation, has modem card, automatic shut-off after 60 seconds of no data, good operating condition, needs cleaning, \$300; another 311, has power supply, no other electronics, excellent mechanical condition, \$150; extensive supply of spare parts, \$50; all of the above together, asking \$400; Wm J. Schenker, M.D., 2086 Essenary, Walnut Creek, CA 94596, (415) 939-6296.

Computer store opens in Sunnyvale—recreational Computer Centers, 1324 South Mary Ave., Sunnyvale, CA 94087. Phone 735-7480.

### CLUB LIBRARY

Gordon French, club librarian, has lots of interesting material and is able to loan it to anyone with a definite need, but . . . please adhere to the following:

\*Limit your telephone calls to the hours of 7PM to 9PM weekdays only. This is important. Gordon's phone number is (415) 325-4209 in Menlo Park.

\*Be specific with your requests and Gordon can probably help you—he cannot randomly review the contents of the library for you.

\*No reproductions will be made of any materials.

\*All materials loaned must be returned so they are available for others to use in the future. □

**For Sale:** IMSAI 8080, 8K Dutronics memory, Polymorphic video terminal interface, Tarbell cassette interface, Altair 2S10 with one port, keyboard and J. C. Penny audio cassette recorder. Assembled. \$1775. Contact J. Gill, 497-4715 (days), 321-6289 (evenings).

**SOL User Group now forming.** If you own or have ordered Processor Technology's SOL computer, please send your name, address, phone number and ideas to Bill Burns, 4190 Maybell Way, Palo Alto, CA 94306.

**Wanted—Carpool or riders to Fairchild** (or Ellis St. area in Mountain View from the Summit Rd. area in the Santa Cruz mountains. Must be willing to get going early as I like to avoid traffic. Joel (415) 962-3372 (days) or (408) 353-2663 (eves).

### HOW TO GET THE NEWSLETTER

Anyone interested in computers as a hobby may receive the *Newsletter* by sending a request to the Homebrew Computer Club Newsletter, P.O. Box 626, Mountain View, CA 94042. The *Newsletter* is distributed monthly at the club meetings and is also mailed to individuals who are unable to attend the meetings. If you have an input to the *Newsletter*, send it in and it will be published as quickly as possible. However, the editors cannot promise that everything sent will be published immediately. All manuscripts must be typed and carefully proofed. All listings and diagrams should be as clear and easy to read as possible.

The *Newsletter* is made possible by your donations. Please remember that we must pay for postage, labels and printing. Donations may be given to Ray Boaz at the club meetings or sent to the above address. □

**STAND-ALONE  
ADAPTER FOR VDM-1**  
By Lee Felsenstein

This circuit allows the operation of the Processor Technology VDM-1 as a stand-alone terminal. It includes a UART for serial data communication with EIA RS-232 signal levels. All data to the VDM comes through the UART, so a "local loopback" connection is necessary from the Data Out terminal to the Data In for half duplex operation. Two switchable Baud rates are available if a SPDT switch is connected to switch Baud Rate to Baud 1 or Baud 2. The Ready output from the UART allows operation from a generalized parallel interface at maximum speed. The Break input moves the output to a space condition and is used as an escape character in various systems.

The circuit requires a connection to an external -16 V to -19 V supply; +5 V power is supplied by pin 16 of IC23 from the regulator of the VDM. The circuit draws very little current since most logic is CMOS. The -12 V and +5 V connections shown are for keyboard power.

On power-up, the circuit initializes to a clear screen with a cursor in the lower left corner. Non-control characters are displayed and rolled up when a 64 character line is filled. CR will terminate a line and roll it up. A LF immediately following the CR will be ignored, as will a LF following any number of DEL (rubout) characters which in turn follow a CR. A second LF, or one without a CR preceding, will be treated like a CR-LF combination. FF will initialize the screen.

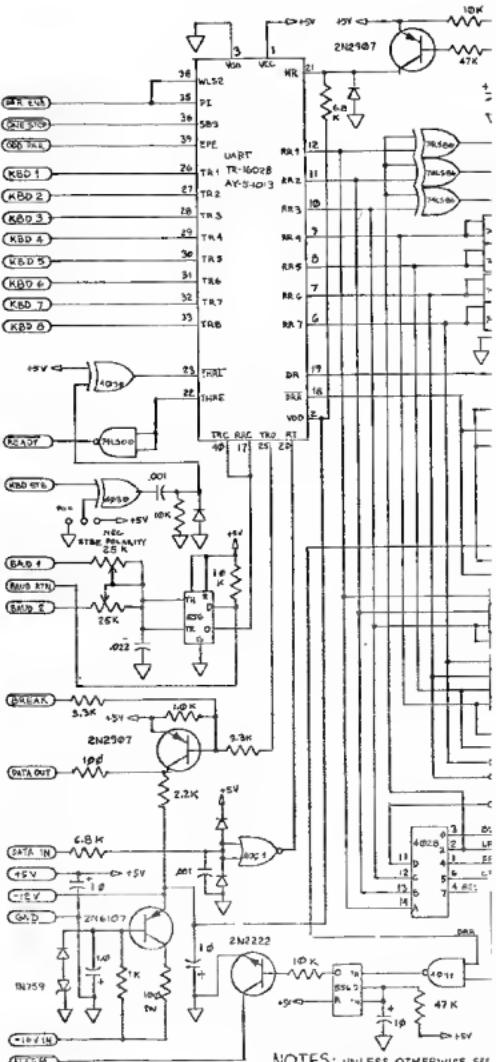
BS will be recognized and the cursor will move back and will erase the last character. At the left end of the line the cursor will jump to the right end and will cause a roll down of the line above. This will not occur if there is not text on the line above. The cursor will jump to the 64th location whether or not it is visible there. If the previous line was terminated by a CR, the cursor disappears until backed over the CR.

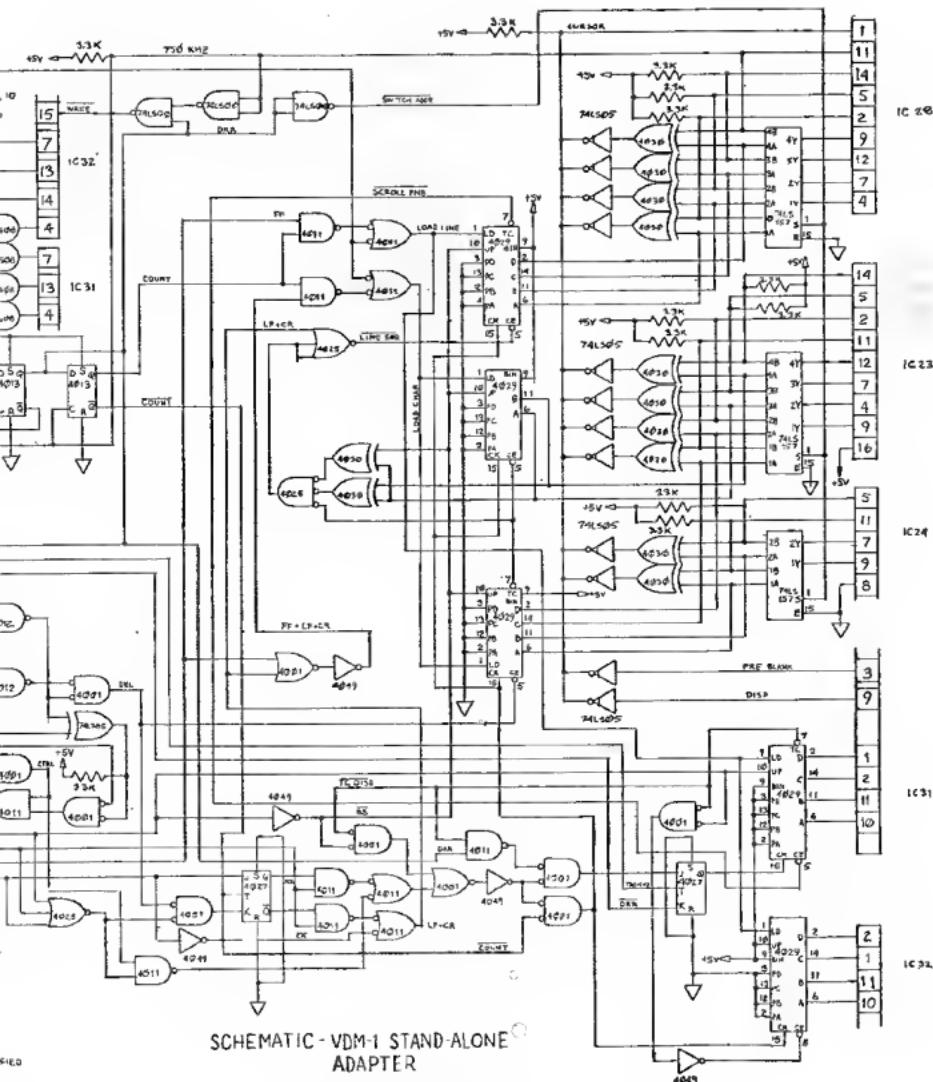
The circuit may be constructed using wire-wrap or solder; layout is not critical except that proper supply bypassing techniques must be used for the TTL ICs. Capacitors ( $0.1\mu F$ ) should be connected between the +5 V and GND pins of these ICs to prevent supply current pulses.

The two boards may be interconnected with ribbon cables and DIP headers which plug into the IC sockets indicated on the drawing.

**THE FOLLOWING MODIFICATIONS TO THE VDM  
ARE NECESSARY**

1. Cut trace on solder side from pin 4 of IC 17.
2. Cut trace from pin 13 of IC 10 on component side.
3. Connect a jumper from pin 6 of IC 17 to pin 13 of IC 10.
4. Connect a jumper from pin 7 of IC 31 to pin 4 of IC 17.
5. Connect a jumper from pin 3 of IC 31 to pin 7 of IC 13.
6. Connect a jumper from pin 8 of IC 15 to pin 9 of IC 31.
7. Connect a jumper from pin 3 of IC 41 to pin 15 of IC 31.
8. Remove ICs 18, 23, 24, 28, 29, 31, 32, 33, 34, 35, 37, 38, 39 and 40.
9. If not yet installed, resistors R27 through R32 and R41 through R48 may be omitted from assembly. □





SCHEMATIC - VDM-1 STAND-ALONE  
ADAPTER

24 APR 1976

- GORDON FRENCH'S CHUFF-CHOOS TRAIN OR
- IDLE FANTASIES ON A VDM SCREEN

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0000	0010	0000	(00000000[99])	0000
0000	0020	0000	/ 0-0-0-0 0-0	0000
0000	0030	0000	0000	0000
0000	0040	0000	0000	0000
0000	0050	0000	0000	0000
0000	0060	0000	0000	0000
0000	0070	*	0000	0000
0020 AF	0080 TRAIN	XRA	A	DNCE UPON A TIME,
0021 D3 C8	0090 OUT	0C8H	IN A CURIOUS LITTLE	0000
0023 21 84 01	0100 LXI	H*SHED	PLACE THERE WAS -	0000
0026 01 00 08	0110 LXI	B*2048	..A TINY TRAIN	0000
0029 36 23	0120 EMPTY	MVI	.. AND IT STAYED IN A	0000
002B 23	0130 INX	M*20H	.. TINY SHED	0000
002C 0B	0140 DCX	H	.. THAT WAS ALL EMPTY	0000
002D AF	0150 XRA	B	0000	0000
002E A8	0160 XRA	A	0000	0000
002F C2 09 03	0170 JNZ	B	0000	0000
0012 21 F7 02	0180 LXI	EMPTY	0000	0000
0015 11 00 00	0190 LXI	H*CLDUD	..EXCEPT FOR A HUGE	0000
0018 06 00	0200 LXI	D*0	0000	0000
001A CD 50 00	0210 MVI	B*14	B	0000
001D 11 2B 00	0220 CALL	SMD1	I	0000
0020 06 00	0230 LXI	D*43	L	0000
0022 CD 50 00	0240 MVI	B*12	L	0000
0025 11 30 00	0250 CALL	SM01	O	0000
0028 06 09	0260 LXI	D*43	W	0000
002A CD 50 00	0270 MVI	B*9	Y	0000
002D 11 34 00	0280 CALL	SM01	Z	0000
0030 06 04	0290 LXI	D*52	C	0000
0032 CD 50 00	0300 MVI	B*4	L	0000
0035 11 3B 00	0310 CALL	SM01	O	0000
0038 06 02	0320 LXI	D*59	U	0000
003A CD 50 00	0330 MVI	B*2	D	0000
003D 11 3C 00	0340 CALL	SM01	S	0000
0040 06 01	0350 LXI	D*60	M	0000
0042 CD 50 00	0360 MVI	B*1	O	0000
0045 11 3E 00	0370 CALL	SMD1	F	0000
0048 06 01	0380 LXI	D*62	K	0000
004A CD 50 00	0390 MVI	B*1	E	0000
004D C3 59 00	0400 CALL	SM01	CDUGH	0000
0050	0410 *	JMP	ENGIN	0000
0050 19	0420 SMD1	DAD	D	0000
0051 36 6F	0430 SM02	MVI	M*SMOKE	0000
0053 23	0440 INX	H	..CDUGH	0000
0054 05	0450 DCR	B	..CDUGH	0000
0055 C2 51 00	0460 JNZ	SM02	0000	0000
0056 C9	0470 RET	*	COMING OUT OF THE STACK	0000

0059		0450 *		
0059	21 A6 04	0490 ENGINE LXI	H+SHED+322H	A TINY LOCOMOTIVE
005C	36 16	0500 MVI	M+16H	WITH A LITTLE SMOKESTAK
005E	21 A9 04	0510 LXI	H+SHED+325H	AND A LITTLE BELL
0061	36 07	0520 MVI	M+07H	
0063	21 AB 04	0530 LXI	H+SHED+327H	..AND A TINY DOME
0066	36 EE	0540 MVI	M+6EH	
0068	2A 66 01	0550 LHLD	CAB1 .. AND A CAB	
006B	22 AE 04	0560 SHLD	SHED+32AH WITH WINDOWS	
006E	2A 6B 01	0570 LHLD	CAB2 .. SO THAT YOU COULD	
0071	22 B0 04	0580 SHLD	SHED+32CH SEE INTO WHERE THE	
0074	2A 6A 01	0590 LHLD	CAB3 .. ENGINEER AND THE	
0077	22 B2 04	0600 SHLD	SHED+32EH FIREMAN SAT.	
007A	2A 6C 01	0610 LHLD	BO11 .. IT HAD A BEAUTIFUL	
007D	22 E5 04	0620 SHLD	SHED+361H POLISHED	
0080	2A 6E 01	0630 LHLD	BO12 .. BRASS	
0083	22 E7 04	0640 SHLD	SHED+363H BOILER	
0086	2A 70 01	0650 LHLD	BO13 .. WITH	
0089	22 E9 04	0660 SHLD	SHED+365H THE NUMBER	
009C	22 EB 04	0670 SHLD	SHED+367H "99" ON THE	
009F	2A 72 01	0680 LHLD	BO14 .. SIDE OF	
0092	22 ED 04	0690 SHLD	SHED+369H THE CAB	
0095	2A 74 01	0700 LHLD	BO15 .. BUT YOU COULDN'T	
0098	22 EF 04	0710 SHLD	SHED+36BH SEE EITHER THE	
009B	2A 76 01	0720 LHLD	BO16 .. ENGINEER OR THE	
009E	22 F1 04	0730 SHLD	SHED+36DH FIREMAN	
00A1	2A 78 01	0740 LHLD	FRA1 .. THE LITTLE ENGINE	
00A4	22 F4 05	0750 SHLD	SHED+3A2H ALSO	
00A7	2A 7A 01	0760 LHLD	FRA2 .. HAD A COWCATCHER	
00AA	22 26 05	0770 SHLD	SHED+3A2H AND LOTS OF FUNNY	
00AD	22 28 05	0780 SHLD	SHED+3A4H WHEELS AND THE	
00B0	22 2A 05	0790 SHLD	SHED+3A4H THINGS THAT CONNECTED	
00B3	2A 7C 01	0800 LHLD	FRA3 .. AND TWO VERY TINY	
00B6	22 2C 05	0810 SHLD	SHED+3A8H WHEELS AT THE VERY	
00B9	2A 7E 01	0820 LHLD	FRA4 .. VERY BACK	
00BC	22 2E 05	0830 SHLD	SHED+3AAH ALTOGETHER IT LOOKED	
00BF	2A B0 01	0840 LHLD	FRA5 .. QUITE LONELY AND YET	
00C2	22 30 05	0850 SHLD	SHED+3A8H IT APPEARED VERY	
00C5	01 DF FF	0860 LXI	B+-21H .. FUNNY JUST SITTING	
00C8	21 62 F5	0870 LXI	H+SHED+3DEH THERE ON THE	
00CB	36 19	0880 RAILS	M+19H .. RAILS	
00CD	03	0890 INX	B .. WITH NOTHING AT ALL	
00CE	23	0900 INX	H .. EVER	
00CF	AF	0910 XRA	A .. TO DO	
00D0	AB	0920 XRA	B .. W E L L !	
00D1	C2 CB AB	0930 JNZ	RAILS .. LET'S RUN IT JUST FOR	
			FUN	
00D4	21 00 CC	0940 HOSTL	LXI	H+RRY GET TRAIN OUT OF SHED
00D7	EB	0950 XCHG	*	MOVE IT FROM SHED
00D8	21 BA 01	0960 LXI	H+SHED	
00D9	7E	0970 FIRE	MOV	A+M LIGHT FIRE
00DC	23	0980 INX	H	
00DD	EB	0990 XCHG		
00DE	77	1000 MOV	M+A ..MOVE IT	
00DF	23	1010 INX	H	
00E0	7C	1020 MOV	A+H	
00E1	EB	1030 XCHG		
00E2	FE DB	1040 CPI	ØDØH END OF YARD?	
00E4	C2 DB 00	1050 JNZ	FIRE NO. MAKE MORE STEAM!	
00E7	CD ED 00	1060 CALL	TRAVL GO TAKE TRIP	
00EA	C3 D4 00	1070 JMP	HOSTLE NO ROUND TRIPS; JUST DO	
			AGAIN	

00ED	1080 *		
00EF 01 40 03	1090 TRAVL LXI	E,64*13 MAKE TRIP 13 MILES	
00F0 C5	1100 CHOO PUSH B	CHUFF ONCE	
00F1 CD FF 00	1110 CALL STROK	MAKE FORWARD MOTION	
00F4 CO DF 01	1120 CALL TURN	TURN WHEELS	
00F7 C1	1130 POP B		
00F8 03	1140 DCX B	CLICK ODOMETER	
00F9 AF	1150 XRA A		
00FA AB	1160 XRA B	13 MILES YET?	
00FB C2 F0 00	1170 JNZ CHOO NO		
00FE C9	1180 RET *	DO NEXT TRIP	
00FF	1190 *		
00FF 21 01 CC	1200 STROK LXI	H,0CC01H MOVE DOWN THE TRACK	
0100 0E D0	1210 MVI C,0D0H		
0104 7E	1220 COAL MOV A,M	ADO MORE COAL	
0105 28	1230 DCX H		
0106 77	1240 MOV M,A		
0107 23	1250 INX H		
0108 23	1260 INX H		
0109 7C	1270 MOV A,H		
010A B9	1280 CMP C	ENOUGH COALT?	
010B C2 34 01	1290 JNZ COAL	NO, PUT MORE ON!	
010E C9	1300 RET		
012F	1310 *		
010F 21 00 CC	1320 TURN LXI	H,0CC00H TURN WHEELS	
0112 7E	1330 HISS MOV A,M		
0113 23	1340 INX H		
0114 FE 06	1350 CPI G	FIND COWGITCHER	
0116 C2 12 01	1360 JNZ HISS	LOOK AGAIN	
0119 23	1370 FOUND INX H		
011A 7E	1380 AXLE MOV A,M		
011B FE 11	1390 CPI 1H	WHAT QUARTER TURN?	
011D C2 31 01	1400 JNZ NXT1		
0120 11 7E 14	1410 LXI D,147EH	NEXT QUARTER TURN	
0123	1420 *		
0123 06 07	1430 AXL1 MVI B,7	DO 4 AXLES	
0125 72	1440 AXL2 MOV M,D	WHEELS MOVED HERE	
0126 05	1450 DCR B	LAST WHEEL?	
0127 CA 52 01	1460 JZ WORK	I'VE BEEN WORKIN'...	
012A 23	1470 INX H	..ON THE RAILROAD..	
012B 73	1480 MOV M,E	(SIDE RODS MOVED HERE)	
012C 23	1490 INX H	..ALL THE LIVE..	
012D 05	1500 DCR B	..LONG DAY.....	
012E C2 25 01	1510 JNZ AXL2		
0131	1520 *		
0131 FE 14	1530 NXT1 CPI 14H	QUARTER TURN	
0133 C2 3C 01	1540 JNZ NXT2		
0136 11 2D 13	1550 LXI D,132DH		
0139 C3 23 01	1560 JMP AXL1		
013C FE 13	1570 NXT2 CPI 13H	QUARTER TURN	
013E C2 47 01	1580 JNZ NXT3		
0141 11 5F 12	1590 LXI D,125PH		
0144 C3 23 01	1600 JMP AXL1		
0147 FE 12	1610 NXT3 CPI 12H	QUARTER TURN	
0149 C2 1A 01	1620 JNZ AXL2		
014C 11 2D 11	1630 LXI D,112DH		
014F C3 23 01	1640 JMP AXL1		
0152	1650 *		
0152 01 PG 0B	1660 WORK LXI B,3000		

0155 08	1670 OIL	DCX	B,	
0156 08	1680	IN	0	DID THE CONDUCTOR
0158 E6 40	1690	ANI	RDA	..FLAG US DOWN?
015A C2 63 01	1700	JNZ	QUIT	QUITTIN' TIME
015D AF	1710	XRA	A	NO. THEN HIGHBALL
015E A8	1720	XRA	B	
015F C2 55 01	1730	JNZ	OIL	NO SQUEEKS! PLEASE!
0162 C9	1740	RET		
0163	1750 *			
0163 C3 60 EA	1760 * PUT A JUMP TO WHEREVER YOU NEED TO RETURN IN THE NEXT HERE			
0163	1770 QUIT	JMP	ALSB	..YOUR RETURN LINK GOES
0166	1780 *			
0166	1790 RDA	EQU	40H	PUT YOUR DATA READY FLAG
0166	1800 PRY	EQU	7CC00H	
0166	1810 SMOKE	EQU	6FH	SMOKE CHARACTER
0166 01 10	1820 CAB1	DW	1001H	CAB DESCRIPTION
0168 10 5D	1830 CAB2	DW	5D10H	" "
016A 7E 20	1840 CAB3	DW	207EH	" "
016C 28 2A	1850 BO11	DW	2A28H	BOILER DESCRIPTION
016E 0A 19	1860 BO12	DW	190AH	" "
0170 0A 0A	1870 BO13	DW	2A0AH	" "
0172 0A 5B	1880 BO14	DW	550AH	" "
0174 39 39	1890 BO15	DW	3939H	" "
0176 5D 20	1900 BO16	DW	205DH	" "
0178 26 20	1910 FRA1	DW	2006H	FRAME DESCRIPTION
017A 11 20	1920 FRA2	DW	2D11H	" "
017C 11 22	1930 FRA3	DW	2D11H	" "
017E 6F 2D	1940 FRA4	DW	2D6FH	" "
0180 6F 20	1950 FRA5	DW	206FH	" "
0182 19 19	1960 TIES	DW	1919H	TIES DESCRIPTION
0184 22	1970 SHED	NOP	*	THIS IS SHED AREA
0185	1980 CLOUD	EQU	f+0172H	BEGINNING OF CLOUD
0185	1990 *			
0185	2000 *			

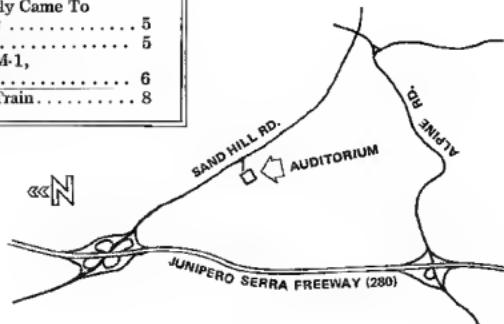
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**HOMEBREW COMPUTER CLUB MEETINGS***Where & When*

The Homebrew Computer Club meets a 7 p.m. at the Stanford Linear Accelerator Center Auditorium. Dates scheduled for the remainder of this year are December 10 and 22. The date and location are subject to change. If a change does occur, every effort will be made to provide advance notice in the Newsletter.

**HOMEBREW COMPUTER CLUB  
NEWSLETTER**

P.O. Box 626  
Mountain View, CA 94042

**FIRST CLASS MAIL**

**STAND-ALONE  
ADAPTER FOR VDM-1**  
By Lee Felsenstein

This circuit allows the operation of the Processor Technology VDM-1 as a stand-alone terminal. It includes a UART for serial data communication with EIA RS-232 signal levels. All data to the VDM comes through the UART, so a "local loopback" connection is necessary from the Data Out terminal to the Data In for half duplex operation. Two switchable Baud rates are available if a SPDT switch is connected to switch Baud Rtn to Baud 1 or Baud 2. The Ready output from the UART allows operation from a generalized parallel interface at maximum speed. The Break input moves the output to a space condition and is used as an escape character in various systems.

The circuit requires a connection to an external -16 V to -19 V supply; +5 V power is supplied by pin 16 of IC23 from the regulator of the VDM. The circuit draws very little current since most logic is CMOS. The -12 V and +5 V connections shown are for keyboard power.

On power-up, the circuit initializes to a clear screen with a cursor in the lower left corner. Non-control characters are displayed and rolled up when a 64 character line is filled. CR will terminate a line and roll it up. A LF immediately following the CR will be ignored, as will a LF following any number of DEL (rub-out) characters which in turn follow a CR. A second LF or one without a CR preceding, will be treated like a CR-LF combination. FF will initialize the screen.

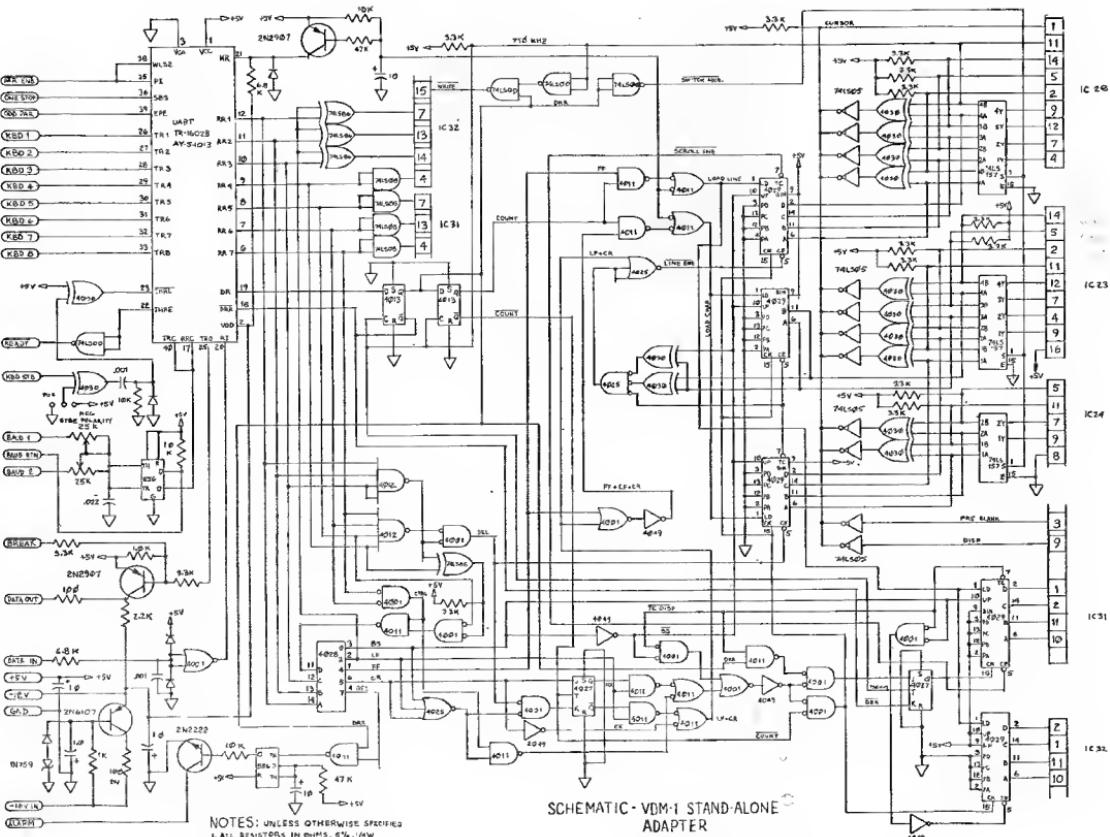
BS will be recognized and the cursor will move back and will erase the last character. At the left end of the line the cursor will jump to the right end and will cause a roll down of the line above. This will not occur if there is no text on the line above. The cursor will jump to the 64th location whether or not it is visible there. If the previous line was terminated by a CR, the cursor disappears until backed over the CR.

The circuit may be constructed using wire-wrap or solder; layout is not critical except that proper supply bypassing techniques must be used for the TTL ICs. Capacitors (0.1μF) should be connected between the +5 V and GND pins of these ICs to prevent supply current pulses.

The two boards may be interconnected with ribbon cables and DIP headers which plug into the IC sockets indicated on the drawing.

**THE FOLLOWING MODIFICATIONS TO THE VDM  
ARE NECESSARY**

- Cut trace on solder side from pin 4 of IC 17.
- Cut trace from pin 13 of IC 10 on component side.
- Connect a jumper from pin 6 of IC 17 to pin 13 of IC 10.
- Connect a jumper from pin 7 of IC 31 to pin 4 of IC 17.
- Connect a jumper from pin 3 of IC 31 to pin 7 of IC 13.
- Connect a jumper from pin 8 of IC 15 to pin 9 of IC 31.
- Connect a jumper from pin 3 of IC 41 to pin 15 of IC 31.
- Remove ICs 18, 23, 24, 28, 29, 31, 32, 33, 34, 35, 37, 38, 39 and 40.
- If not yet installed, resistors R27 through R32 and R41 through R48 may be omitted from assembly. □



**SCHEMATIC - VDM-1 STAND-ALONE  
ADAPTER**

24 APR 1976 L.FELSENSTEIN